CDMS
Progress and Plans

Progress at Soudan

- Steady running at 50 mK since November 2006!
- More than 1500 kg-days Ge detector exposure

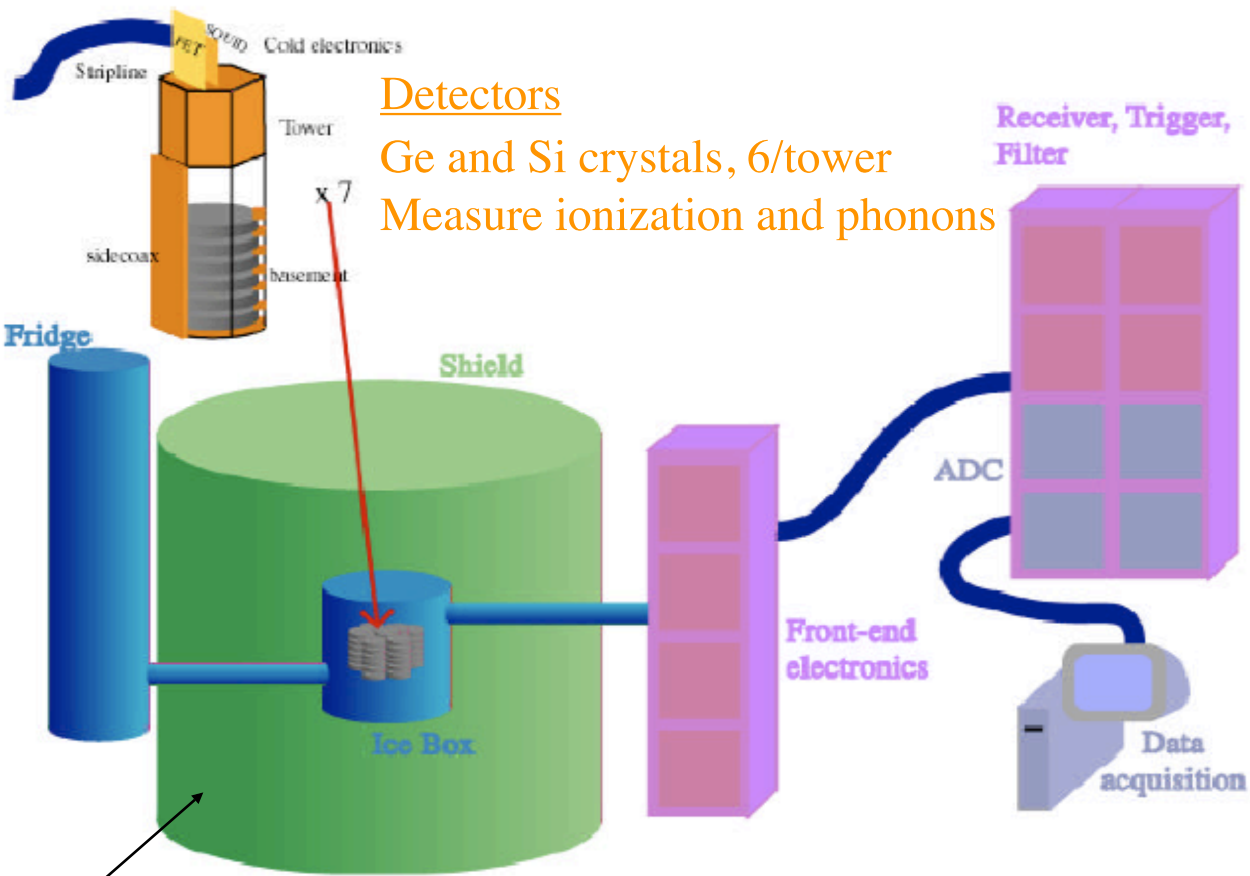
Prospects at Soudan

- Installation of new detectors planned for 2009

The Future - SuperCDMS

- Phased deployment at Soudan -> SNOLAB
- Eventual goal is x100 improved sensitivity to WIMPs

CDMS in a nutshell



Detectors

Ge and Si crystals, 6/tower

Measure ionization and phonons

Electronics /DAQ

Record signals from detectors and veto; form trigger

Cryogenics

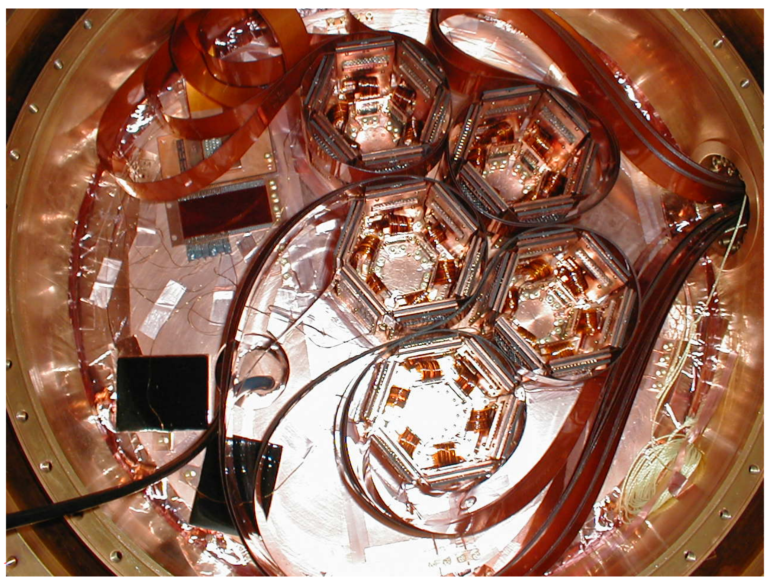
Maintain detectors at <50 mK

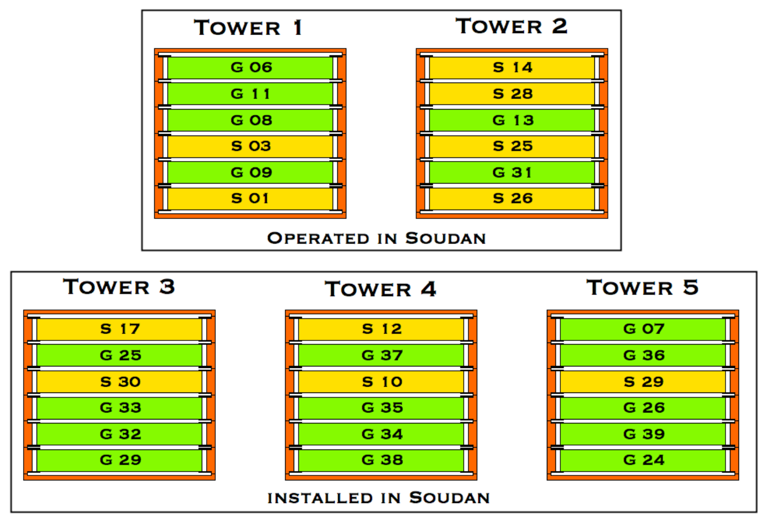
Shielding

Layered shielding (Cu, Pb, polyethylene) reduces radioactive backgrounds and active scintillator veto is >99.9% efficient against cosmic rays. Soudan overburden (2341’) reduces cosmic ray flux.

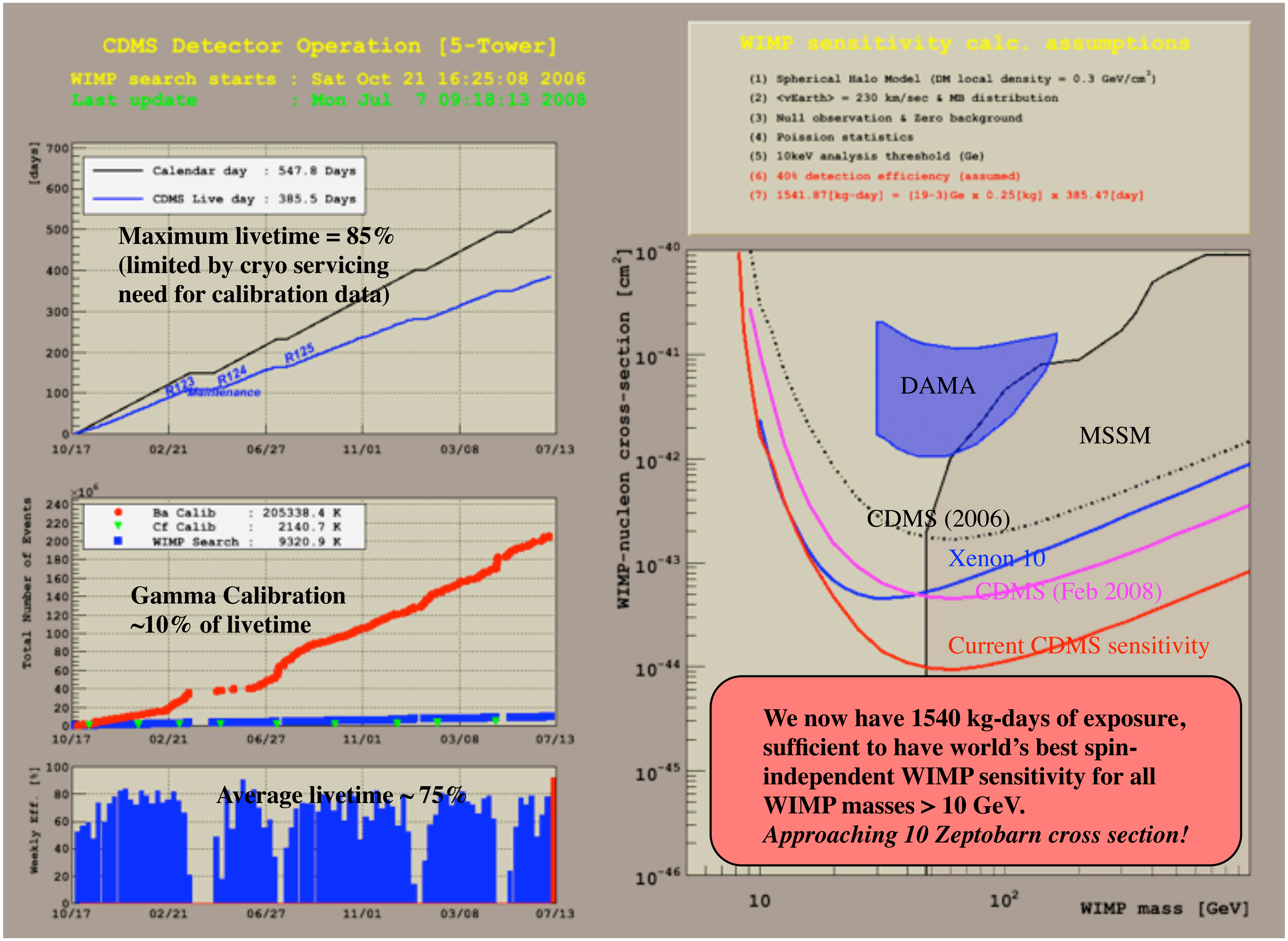
Cryogenics and Detectors

- Cryogenics Upgrades (2005-2006)
  - Better vacuum to improve stability, decrease maintenance
  - Better remote control and monitoring (experiment can be operated from surface)
  - Improved cooling at 4K with cryocooler on electronics stem; reduce Lhe consumption, costs; had to deal with vibration problems
- Detector Payload
  - 30 detectors (19 Ge, 11 Si); total of 4.5 kg Ge, 1 kg Si
  - Thermal connections to refrigerator improved to reach base temperature of 42 mK





>1.5 years of data taking at Soudan



Operational Issues

- Occasional short (~1 week) warming to 4-77K necessary
  - Service pumps, clean 3He/4He mixture
  - Eliminate frozen air accumulation from small leaks
- Nearly immune to main power outages
  - Underground diesel generator backs up entire cryogenics system
  - Sufficient UPS to maintain electronics for ~ 1hour
  - Remote control, monitoring and analysis from surface

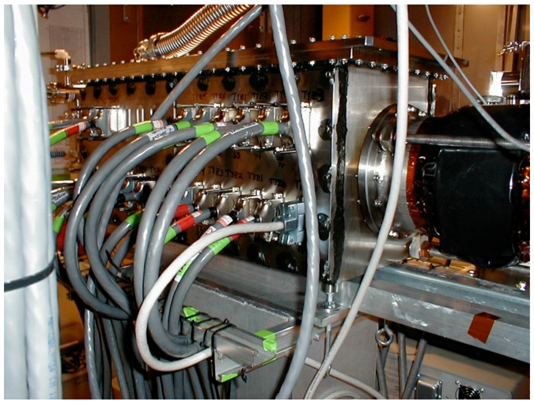
Underground diesel generator to maintain cryogenics

Large UPS to backup electronics

Upcoming Maintenance Issues (2009)

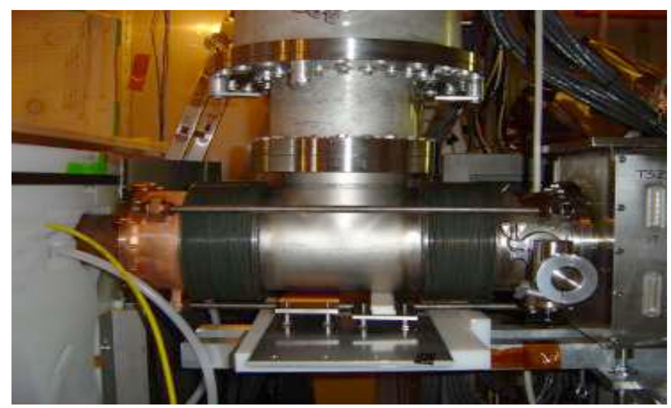
Replace vacuum bulkhead box where signals emerge (ebox)

- Continuing small air leak is troublesome
- New ebox tested and ready to ship to Soudan



Replace cryocooler head

- Already at 150% of recommended lifetime
- No sign of degradation yet, but better to be safe than sorry



Two small dark clouds on the horizon

Soudan underground power feed

- Recently repairs after lightning strikes required outages
- Near maximum capacity; may need new feed to maintain CDMS/MINOS

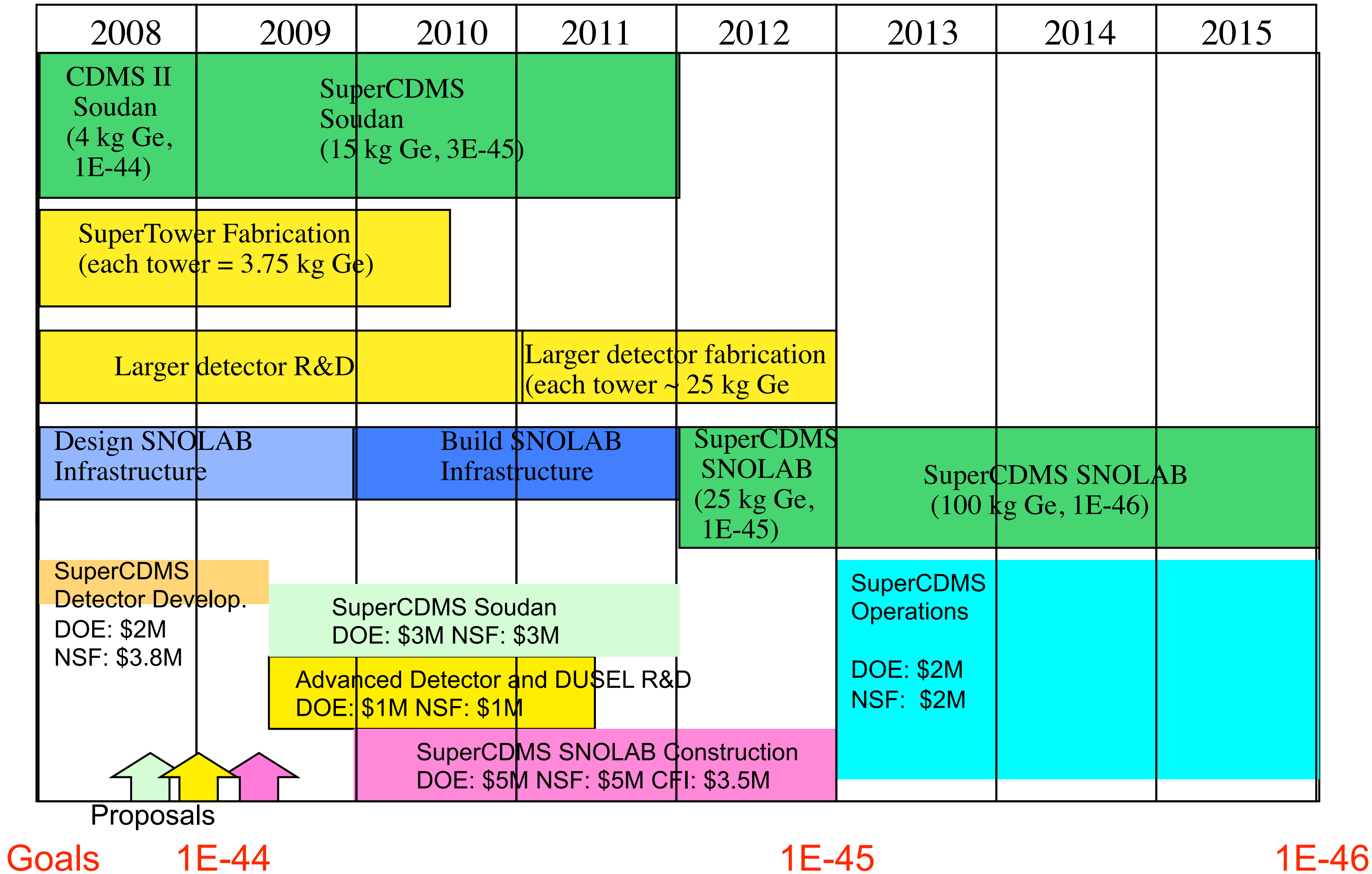
Helium costs and availability

- He costs are skyrocketing and availability is becoming an issue
  - 36% increase in costs this summer
  - Several instances where supply was very tight in last couple of years
  - CDMS uses about 70l/day
- Possible solution: He liquefier at Soudan
  - Cryocooler-based liquefiers are now available
    - Low maintenance, and low power (~7.5 kw), but capacity ~ 10 l/day
    - Capital cost ~ $60K
  - Have surplus piston liquefier at FNAL
    - Much higher capacity (20 l/hour), enough for our whole usage!
    - But significant maintenance required (tech travel to Soudan)
    - Consume a lot of electric power (30-40 kW)

The Future: SuperCDMS

- Science goals
  - Increase sensitivity by x100 (compared with current)
    - Reach WIMP-nucleon cross section of 10^{-46} cm^2
  - Find WIMP signal and compare with LHC
- Technical goals
  - Increase detector mass in stages
    - Soudan (4 kg -> 15 kg by 2010)
    - SNOLAB (100 kg by 2012)
  - Stay background free
    - Challenge to deal with existing backgrounds at Soudan
    - New experiment needed at SNOLAB to reduce neutron background
- Current status
  - First Soudan stage funded by DOE/NSF
  - SNOLAB experiment has CD-0 and Stage 1 approval from FNAL Director
  - DMSAG review in 2009 needed for DOE/NSF to approve

SuperCDMS


2008
2009
2010
2011
2012
2013
2014
2015
CDMS II Soudan (4 kg Ge, 1E-44)
SuperCDMS Soudan (15 kg Ge, 3E-45)
SuperTower Fabrication (each tower = 3.75 kg Ge)
Larger detector R&D
Larger detector fabrication (each tower ~ 25 kg Ge
Design SNOLAB Infrastructure
Build SNOLAB Infrastructure
SuperCDMS SNOLAB (25 kg Ge, 1E-45)
SuperCDMS SNOLAB (100 kg Ge, 1E-46)
SuperCDMS Detector Develop.
DOE: $2M
NSF: $3.8M
SuperCDMS Soudan
DOE: $3M NSF: $3M
Advanced Detector and DUSEL R&D
DOE: $1M NSF: $1M
SuperCDMS SNOLAB Construction
DOE: $5M NSF: $5M CFI: $3.5M
SuperCDMS Operations
DOE: $2M
NSF: $2M
Proposals
Goals
1E-44
1E-45
1E-46